THE " A L R O " CALCULATING DISC TYPE 700 H.

General

This "Alro" calculating disc being fully adapted to practice has been specially designed for radio engineers. The specialised scales for high-frequency calculations are giving the values with the true decimal point, which is of great importance in view of the large numbers with which one often has to calculate.
With the aid of the calculating disc the relation between inductance (L), capacity (C) and frequency (ν) resp. wave-length (λ) can be determined very quickly according to the formula:

$$4\pi^2\nu^2 LC = 1 \text{ or } \nu = \frac{1}{2\pi}\sqrt{\frac{1}{LC}}$$

Further the disc contains a decibel-scale which is very useful when making power amplification- and power attenuation calculations.

$$db = 10 \log \frac{W1}{W2} = 20 \log \frac{V1}{V2}$$

when V1 and V2 refer to the same resistance.

Description

The disc contains the undermentioned scales:

Mainscale (N)	for multiplications, divisions and extractions of root	
Capacityscale (C)	range:	1 - 10.000 pF
Inductancescale (L)	"	1 μH - 5 mH
Frequencyscale (ν)	"	20 kc/s - 500 Mc/s
Wavelengthscale (λ)	"	0,6 m - 15.000 m
Decibelscale (db)	"	+ or - 20 db

As auxiliary scale in the lid:

Logarithm scale as well as a number of data of general importance.

Manipulation

Put the instrument, which when closed will fit your coat pocket, opened down in front of you. The scales now are tilted at an angle of 45°. Put the little finger the ring and the middle finger of the left hand behind the disc carrying the revolving scales and let the little finger rest on the lid, which in this way acts as a base. Owing to the light pressure thus exercised the instrument cannot move when the disc is being turned. The forefinger being put to the milled edge of the disc will thus be able to revolve the exterior scales. When turning the disc the thumb rests on the metal underneath, and is used for moving the hairline.
The right hand thus always remains free to write down the results.

Multiplication

For this purpose the two mainscales marked N are used. The revolving mainscale will be indicated as r.m.s., the fixed mainscale as f.m.s. The beginning of both scales is indicated by a black triangle, called the "Indicator".

To calculate: 5 x 7 x 9

Place the indicator opposite the number 5 on the f.m.s. Put the hairline over the number 7 on the r.m.s. Under the hairline we now have on the f.m.s. the product 5 x 7. As we don't need this figure we don't read it but immediately go on and multiply it by 9. For this we revolve the indicator and put it opposite the product 5 x 7 indicated by the hairline on the f.m.s. The hairline thus merely serves to remember the result. Opposite the number 9 on the r.m.s. we now read the product 5 x 7 x 9 = 315 on the f.m.s.

The place of the decimal point

To find the place of the decimal point one makes a rough calculation by heart with simplified numbers in which way making errors is easily avoided.

Division

A division is the opposite of a multiplication so on the disc one also makes the manipulation the other way round.

To calculate: 72 : 8

Turn the hairline over number 72 of the f.m.s. and revolve number 8 of the r.m.s. under the hairline: read the result 9 opposite the revolving indicator on the f.m.s.

Determination of a square root

Put the hairline over the number on the f.m.s. from which one will extract the square root. Now revolve the r.m.s. just as long till the revolving "Indicator" points at the same number as is indicated by the hairline on the r.m.s. This number is the square root to be found.

Example: $\sqrt{16}$

Put the hairline over number 16 on the f.m.s. Now revolve just as long till both numbers are equal. One finds 4.

Determination of the logarithm of Brigg

This is done with the aid of the spiral-type double scale which is situated in the lid.

Example: log 2 = 0,301

Opposite number 2 of inner-scale one will find number 0,301.

Using the high-frequency scales

Given: capacity and inductance

To find: wave-length and frequency

Turn hairline over fixed Indicator. Now turn capacity, read on scale C, under the hairline: turn hairline over inductance, read on scale L.; the hairline will now indicate the wave-length and the frequency on the scales in question.

Starting from a given wave-length and inductance one will also easily find the capacity or starting from a frequency or wave-length and capacity one will find the inductance.

Using the decibel scale

With the aid of this scale one can easily make voltage-calculations with filters or amplifiers.

Example 1: To find the output-voltage of a filter the attenuation of which amounts to 11 db with a given input-voltage of 6 Volt.

Turn number 6 of the scale marked Voltage (the r.m.s.) opposite the fixed Indicator. Turn hairline over number -11 of the decibel-scale (black figures) and read the output-voltage 1,691 Volt on the Voltage-scale under the hairline.

If one has to calculate with amplification the positive values (red figures) of the decibel-scale are used.

Example: 2: The input-voltage of an amplifier with equal input- and output-resistance amounts to 1,5 Volt. The output-voltage of same is 8 Volt.

To find the amplification

Turn hairline over number 8 of the f.m.s. Now revolve number 1,5 of the r.m.s. under the hairline; turn hairline over revolving Indicator and read the amplification 14,54 db on the decibel-scale under the hairline.

If one has to calculate with values greater than 20 db resp. 10-fold of attenuation or amplification the following formula is used:

10 x amplification (attenuation) = +(-) 20 db.

Example 3: The attenuation of a filter amounts to 52 db. To find the input-voltage when the output-voltage amounts to 0,1 Volt.

52 db = 12 + 2 x 20 db.
Put the hairline over number +12 of decibel-scale and read on f.m.s. the number 398. The input-voltage to be found is: 0,1 x 3,98 x 10 x 10 = 39,8 Volt.